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AUTHOR	Ball, Rodney J.; Cook, Desmond L.
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ABSTRACT

The purpose of this study was to determine the relative importance of six criteria of project success and to develop a composite criterion of educational project success. Criteria considered were schedule, cost, quality/performance, follow-onwork, spin-of benefits, customer/client satisfaction, and overall project success. Two hundred and six people associated with a sample of 146 educational projects first ranked the criteria and then rated their own projects accordingly. A number of diagrams graphically present the relative importance of the various criteria as perceived by different groups of respondents. Findings of the study showed that achieving project objectives was considered most important and meeting time and cost constraints was considered rather unimportant in determining the success of projects. A copy of the survey instrument used to gather data for the study is included in the appendix. (Author/JG)

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THE DEVELOPMENT OF SUCCESS CRITERIA FOR EDUCATIONAL RESEARCH AND DEVELOPMENT PROJECTS

by
Rodney J. Ball
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RESEARCH FOR BETTER SCHOOLS, Inc.
1700 MARKET STREET
PHILADELPHIA, PENNSYLVANIA 19103

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Rodney J. Ball*
Desmond L. Cook+

ABSTRACT

The purpose of the study was to determine the relative importance of six criteria of project success and to develop a composite criterion of educational project success. Two hundred and six people associated with a sample of one hundred forty-six educational projects first ranked the criteria and then rated their projects accordingly. Achieving project objectives was considered most important, while meeting project time schedule and cost constraints were rather unimportant in determining the success of projects. This study represents a significant step in developing criteria for the determination of the success of educational projects.

INTRODUCTION

The determination of the final success or failure of research and development projects is an important problem for those concerned with project management in almost all fields of endeavor. One immediate problem encountered in determining project success is defining what is meant by "success." If some criterion can be established, research can be directed toward discovering which variables associated with the management of projects are critical in determining a successful project as contrasted with those inherent in the effort. Project managers and their staffs can then concentrate on those variables as they work to ensure the success of their project efforts.

Previous research at Harvard University[1] and the Massachusetts Institute of Technology[2] has indicated that several criteria are considered when the success of various weapons systems oriented projects are rated. It can not be assumed, however, that these success criteria have the same relative importance in education. For example, in weapon system development the performance criterion proved to be by far the most important. In education, where performance is often quite difficult to measure, remaing within cost and time constraints may be as important or more important than meeting performance specifications.

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* Research for Better Schools, Inc., Philadelphia, Pennsylvania
+ Educational Program Management Center, The Ohio State University, Columbus, Ohio.

Cook[3] recently conducted a research study which resulted in a conceptual framework to be used for the study of project management in education. This work was reported at the Third Annual Seminar Symposium of the Project Management Institute in 1971. The purpose of this effort was to develop a framework which could be used to integrate the results of past and current studies and to direct further research on project management. A schematic of this conceptual framework is presented as Figure 1. Project success represents a major component of the conceptualization. It includes such potential criteria as meeting schedule dates, remaining within cost constraints, meeting quality specifications (objectives), satisfying the customer, obtaining spin-off benefits, and securing support for additional (follow-on) efforts.

The conceptual framework suggests that different persons may have different viewpoints on project success and that these would be reflected in their ranking of possible success criteria. For example, project managers may be most concerned with time, cost, and performance, whereas, parent organization representatives may be quite concerned about spin-off benefits, follow-on work, and customer or funding agency satisfaction.

PURPOSE AND HYPOTHESES

The general purpose of this study was to explore some of the hypotheses suggested by Cook's conceptual framework in regard to the relative importance of different possible criteria of project success in education. Specifically, the objectives of the study were:

(A) To rank schedule, cost, quality (performance), follow-on work, spin-off, and customer satisfaction as possible criteria of educational project success.

(B) To quantify a composite criterion of education project success employing the sub-criteria of schedule, cost, quality, follow-on work, spin-off, and customer satisfaction.

The final ranking of the several criteria of project success has implications for the many governmental and non-governmental organizations who must determine the ultimate success of the educational projects they fund, monitor, and/or plan to implement or institutionalize. That is, the determination of what constitutes a successful project is a necessary initial step in the evaluation of projects.

Once it is known what characterizes a successful project, research can be directed toward discovering which variables in the management of projects are critical in determining a successful project. If the composite criterion of project success resulting from this study is used as the dependent variable, research can be conducted on the relationship of selected independent variables of the framework in order to more firmly establish those management actions on a project that will make it successful.

Within the general purpose and specific objectives, the study proceeded with the following hypotheses.

1) Project principal investigators (project managers), parent organization representatives, and government monitors view the relative importance of the criteria differently.

2) Project principal investigators with previous project management experience view the criteria differently than those without prior experience.

3) Project principal investigators of sponsored projects (conducted under the supervision of a university faculty member) view the criteria differently than those conducting non-sponsored projects.

4) Project principal investigators and parent organization representatives at large institutions view the criteria differently than those from small institutions.

5) The correlations of the different criteria with ratings of overall project success reflect the ranked relative importance given the criteria.

PROCEDURES

A sample of educational projects was first selected and then the personnel associated with the conduct and monitoring of the projects were identified. These people represent the source of data for the study. The sample, data collection instruments, and analysis of data procedures are specified in detail below.

Sample and Data Collection

The data for the study were obtained by means of a ranking form and a rating form administered to the project manager, parent organization representative, and government project monitor associated with each project in a sample of 146 terminated projects funded in one of the several Regions under the Regional Research Program of the National Center for Educational Research and Development, United States Office of Education. The projects were all operated and terminated during the period from September, 1967 to January, 1972; had a maximum government support of $10,000, and were usually conducted or managed by a single "principal investigator."

For the purpose of this study, the six possible criteria were defined as given below.

Schedule refers to meeting project milestone deadlines and the scheduled project termination date as established in the project contract. Success on this dimension means that the project was completed on or before the scheduled termination date and that all subsections or components of the project were completed as scheduled.

Cost refers to meeting the total dollar expenditure predicted for the entire life of the project. Success of this dimension means that the actual dollar cost of the project was less than or coincided with the predicted cost.

Quality/Performance refers to the achievement of the goals and objectives of the project. Success on this dimension means that the performance standards specified by the project objectives were met or exceeded.

Follow-on Work refers to additional contracts or follow-on work obtained as a result of the success of the original project and consequent enhancement of the reputation of the researcher. This criterion is not, however, concerned with additional work obtained as a logical or technical extension of the original project. It is concerned only with whether or not additional work is obtained as a result of the success of the original project.

Spin-off refers to indirect benefits received by the parent institution, its faculty, and the project staff. Success on this dimension means, for example, that the project and/or the parent institution's faculty developed skills as a result of working with the project which can be applied to other areas of the institution's operations. Another important spin-off benefit is the recognition an institution often gains from a highly successful project.

Customer/Client Satisfaction refers to the degree to which the funding agency or user of the end product of the project is satisfied. This criterion is not necessarily concerned with the quality of the project as indicated by whether or not the original objectives and performance standards were met. It is concerned only with the satisfaction of the funding agency or customer with the project or its end product.

Overall Success refers to a general or overall evaluation of the project effort. Was it completed as scheduled? Were the objectives and performance standards met? Were all interested parties satisfied with the effort? Was the project conducted within the estimated cost? Did the project generate additional projects? This criterion is not concerned with any one specific aspect or objective of the project. The concern is with making a general value statement indicating the degree to which the project was a success.

The respondents were requested to rank the relative importance of the six criteria using a paired comparison format. Each respondent was then asked to rate a completed project with which he had been associated on each of the six criteria and a rating of overall project success. These ratings were made on a Likert type scale. A copy of these instruments appears in the Appendix.

The hypotheses required that data be gathered regarding (a) the size of the parent organization housing the projects in the sample, (b) the previous project management experience of the principal investigator, and (c) whether or not each project in the sample was a sponsored (under the supervision of a university faculty member) or non-sponsored project.

Size -- Nearly all the projects in the sample were conducted at a college or university. The total degree credit enrollment in Fall 1969 was used as the measure of parent organization size.

Experience -- Each principal investigator was asked to indicate the number of projects he had managed or directed prior to the project specified in the sample. This number was used as a measure of previous project management experience.

Sponsorship -- Information regarding whether a project was sponsored or not was obtained from the records of a regional office of the Regional Research Program.

Data Analysis

The analysis of the data was organized in terms of answering the questions raised by the five hypotheses of the study. In order to answer these questions, the data were first partitioned based upon the role of the respondent, previous experience of the principal investigator, whether or not the project was sponsored, and the size of the parent organization or institution.

In order to obtain a ranking of the six criteria of project success, the paired comparison data were run on the PCMP computer program of the Psychology Department of The Ohio State University. This program follows the assumptions of the Thurstone Case III model and computes a scale value for each criterion.

In order to measure the agreement of the different partition groups in their rankings of the relative importance of the criteria, an analysis of variance procedure[4] was used in estimating the reliability of scale values given the criteria by the groups. This represents the degree of agreement of the groups or judges in the scale values they have given the criteria. A coefficient of 1.00 represents complete agreement.

In order to obtain a composite criterion of project success, the ratings of projects on the six criteria plus overall success made by the respondents were run on the Wherry Test Selection Program of the Psychology Department of The Ohio State University. The program is a regression analysis program which selects, in order of decreasing importance, the variables contributing significant variance to the prediction of the criterion variable (overall success). For the purpose of this paper, the prediction equations are not presented.

The correlation coefficients of the six criteria with overall project success are discussed in order to indicate the extent to which the ranked relative importance of the criteria is reflected in the ratings of overall project success.

FINDINGS, CONCLUSIONS, AND LIMITATIONS

The results of the data analysis are interpreted in terms of the hypotheses of the study. These hypotheses and findings are listed below along with a discussion of the data analysis results that pertain to each. In order to answer the fifth hypothesis, the correlation coefficients of the six possible criteria with overall project success ratings are discussed under each of the first four hypotheses.

Hypothesis 1 -- Project principal investigators (project managers), parent organization representatives, and government monitors view the relative importance of the criteria differently.

The data analysis indicates that this hypothesis is false. The scale values given the criteria by these two groups are shown in Figure 2. They are nearly the same except for a reversal of schedule and cost, which are the two least important in each case. The reliability coefficient of 0.9559 indicates a considerable amount of agreement between

the two groups in ranking the criteria. The criteria in order of importance are quality, customer satisfaction, spin-off, follow-on, and then schedule and cost.

When the principal investigators and parent organization representatives rated projects using the criteria, the following correlations with overall success ratings resulted respectively.

- o quality (0.5888 and 0.6559)
- o customer satisfaction (0.5748 and 0.5730)
- o spin-off (0.3470 and 0.4746)
- o follow-on (0.3112 and 0.4008)
- o schedule (o.1519 and 0.1362)
- o cost (0.0101 and 0.0019)

Note that the correlation coefficients decreased in size according to the ranked relative importance of the criteria.

The government monitor for all the projects in the study sample ranked the importance of the criteria in the order of quality, spin-off, follow-on, customer satisfaction, cost and schedule. The only important difference in the government monitor's ranking of criteria is the placement of customer satisfaction in a much lower position. Otherwise, the government monitor's rankings are basically the same as those of the principal investigators and parent organization representatives.

When the government monitor rated projects using the criteria, the following correlations with overall success ratings resulted.

- o spin-off (0.7489)
- o quality (0.6459)
- o follow-on (0.6178)
- o customer satisfaction (0.4729)
- o cost (0.2149)
- o schedule (o.1253)

The rank order of criteria based upon the size of the correlation coefficients results in the same order for the criteria as when previously ranked for importance except for the reversal of quality and spin-off in the first two positions.

Hypotheses 2 -- Project principal investigators with previous management experience view the criteria differently than those without prior experience.

The data analysis indicates that this hypothesis is false. The scale values given the criteria by these two groups are shown in Figure 3. There is one important exception, however, in their ranking of the relative importance of the criteria. Principal investigators without prior experience ranked follow-on work markedly lower than spin-off, whereas little or no difference was indicated between follow-on work and spin-off by experienced principal investigators.

When these groups rated the success of projects, follow-on work showed no correlation with overall success ($r=0.0365$), for in-experienced principal investigators, whereas, for experienced ones it correlated second highest ($r=0.6039$) of the six criteria with overall success ratings. It seems then that follow-on work is an important criterion to principal investigators who have previously managed projects but it is not important to principal investigators who have no previous project management experience.

Otherwise, these two groups view the criteria very much the same as is indicated by the reliability coefficient of 0.9771. Again, quality is ranked the highest with customer satisfaction also highly important. Cost and schedule are of least importance.

Hypotheses 3 -- Project principal investigators of sponsored projects (conducted under the supervision of a university faculty member) view the criteria differently than those conducting non-sponsored projects.

The data analysis indicates that the hypothesis is false. The scale values given the criteria by the two groups are very nearly the same. These values are shown in Figure 4. The rank order of the criteria is quality, customer satisfaction, spin-off, follow-on work, cost, and schedule. The same general pattern emerges as with previous comparisons. Quality is at the high end of the scale, the next three criteria are grouped together in the middle, and cost and schedule are at the bottom. Agreement between the groups is high as indicated by the reliability coefficient of 0.9703.

When principal investigators of sponsored projects (usually graduate students in this sample) applied the criteria to rating a project, customer satisfaction had the highest correlation (0.7145) with overall success ratings and spin-off had a relatively low correlation (0.2692), as did cost and schedule (0.2223 and 0.2633).

Hypothesis 4 -- Project principal investigators and parent organization representatives of large institutions view the criteria differently than those from small institutions.

The data analysis indicates that this hypotheses is false. The scale values given the criteria by the two groups are shown in Figure 5. The high level of agreement is seen in the reliability coefficient of 0.9241. As before, quality was ranked the highest with customer satisfaction, spin-off and follow-on work grouped in the middle, and cost and schedule ranked as the least important.

When the groups rated the success of projects, the criterion of spin-off benefits correlated rather high (0.5867) with overall project success for respondents from large institutions and quite low (0.1927) for respondents from small institutions. It appears then that principal investigators and parent organization representatives from large institutions take spin-off benefits more into account when rating the success of projects than do such persons from small institutions.

Conclusions

The following conclusions regarding possible criteria for determining the success of a project in the field of education can be drawn from this study.

1) The criteria of quality/performance (achievement of the goals and objectives of the project) is by far the most important criterion in the minds of educators.

2) The criteria of customer/client satisfaction, spin-off benefits, and follow-on work are also important criteria.

3) The criteria of schedule and cost are of relatively little importance to educators.

4) Project principal investigators and parent organization representatives view the importance of the criteria in the same manner.

5) Follow-on work appears to be an important criterion to principal investigators who have previously managed projects but not to principal investigators without such previous experience.

6) Principal investigators of projects conducted under the sponsorship/supervision of someone else appear to give more importance to the criterion of customer satisfaction than do principal investigators of non-sponsored projects.

7) Principal investigators and parent organization representatives from large institutions appear to take spin-off benefits more into account when rating the success of projects than do such persons from small institutions.

Limitations

Some limitations of the study which may affect the generalizability of the conclusions are listed below.

1) Nearly all the projects in the study sample were conducted at institutions of higher learning.

2) All projects in the sample were relatively small as indicated by a maximum government funding contribution of $10,000.

3) All projects in the sample were conducted in a limited geographic region.

SUMMARY AND RECOMMENDATIONS

The project principal investigators (project managers), parent organization representatives, and government monitor tended to agree that quality is the most important of the six potential criteria of project success suggested in Cook's conceptual framework and that schedule and cost are the least important. When these groups rated the success of projects, the correlations of the six criteria with overall success ratings reflected the ranked relative importance of the criteria.

Further research in the area of developing project success criteria in education ought to include data gathered from projects with large staffs and budgets that are conducted in various educational institutions across the country. Such studies might concentrate on the quantification of some of the success criteria explored in this study. Schedule and cost are probably the easiest to quantify and obtain reliable measures on. They, however, are the least important of the six studied here. Others like quality/performance, customer satisfaction, and spin-off are most difficult to quantify and consequently are harder to obtain valid and reliable measures on.

An important implication of this study is that research on the management of educational projects should be directed at maximizing the achievement of project objectives or performance specifications.

The evaluation of educational projects should be concentrated on such criteria as quality/performance, customer satisfaction, spin-off benefits and follow-on work, and less upon schedule and cost.

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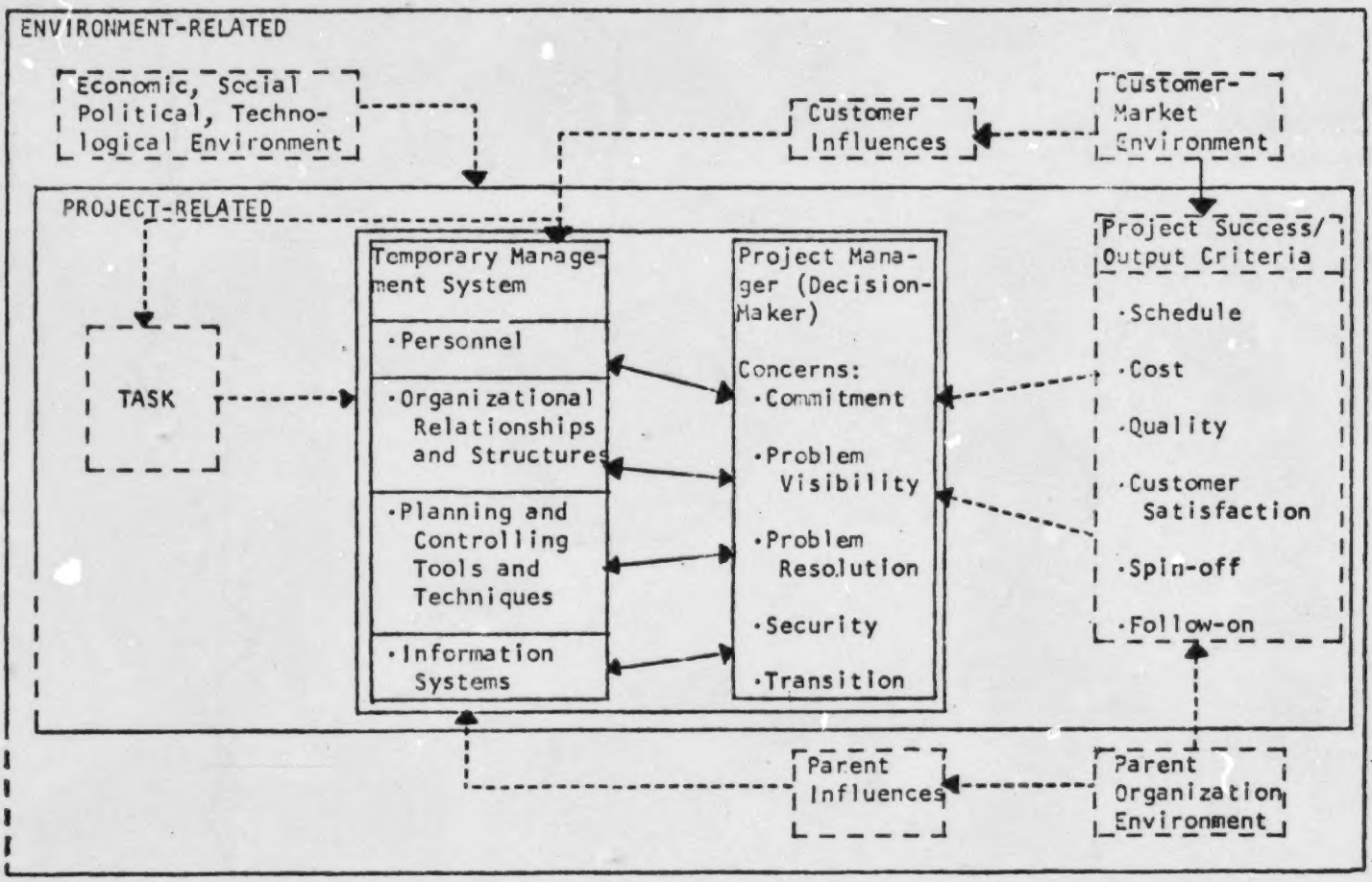

FIGURE 1.--CONCEPTUAL FRAMEWORK FOR PROJECT MANAGEMENT

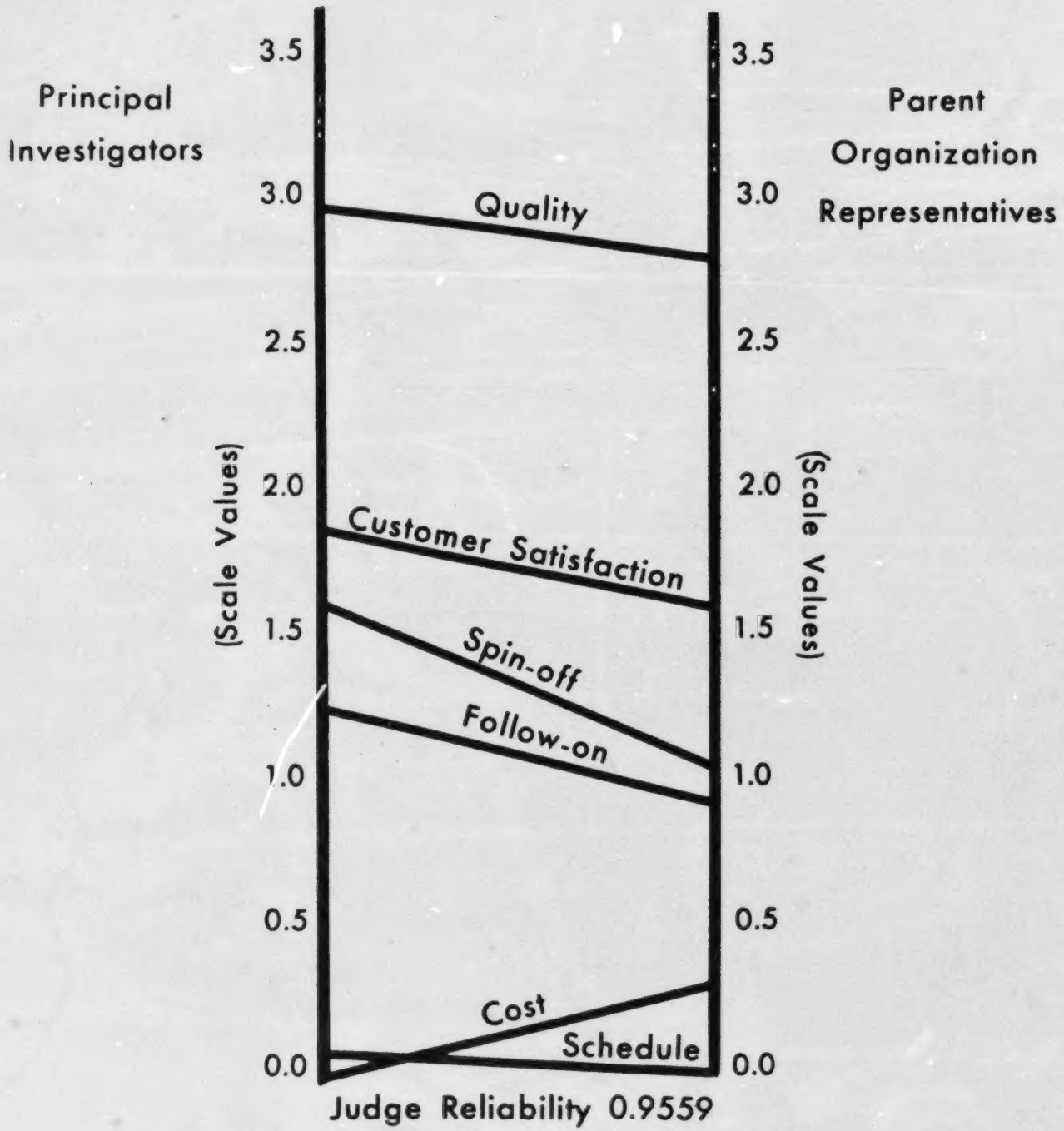

Figure 2

COMPARISON OF SCALE VALUES GIVEN TO CRITERIA OF PROJECT SUCCESS BY PRINCIPAL INVESTIGATORS AND PARENT ORGANIZATION REPRESENTATIVES

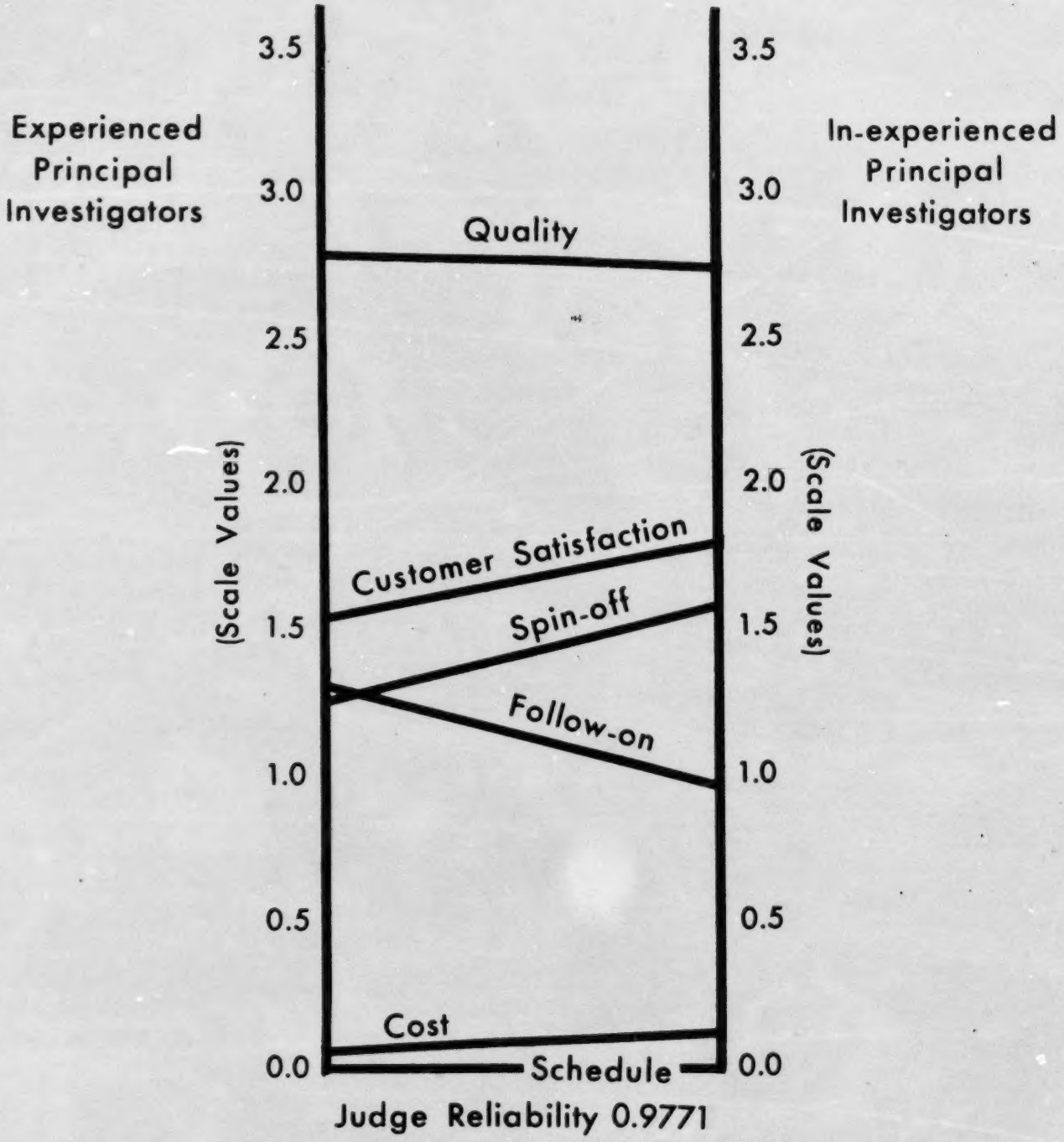

Figure 3

COMPARISON OF SCALE VALUES GIVEN TO CRITERIA OF PROJECT SUCCESS BY EXPERIENCED AND IN-EXPERIENCED PROJECT PRINCIPAL INVESTIGATORS

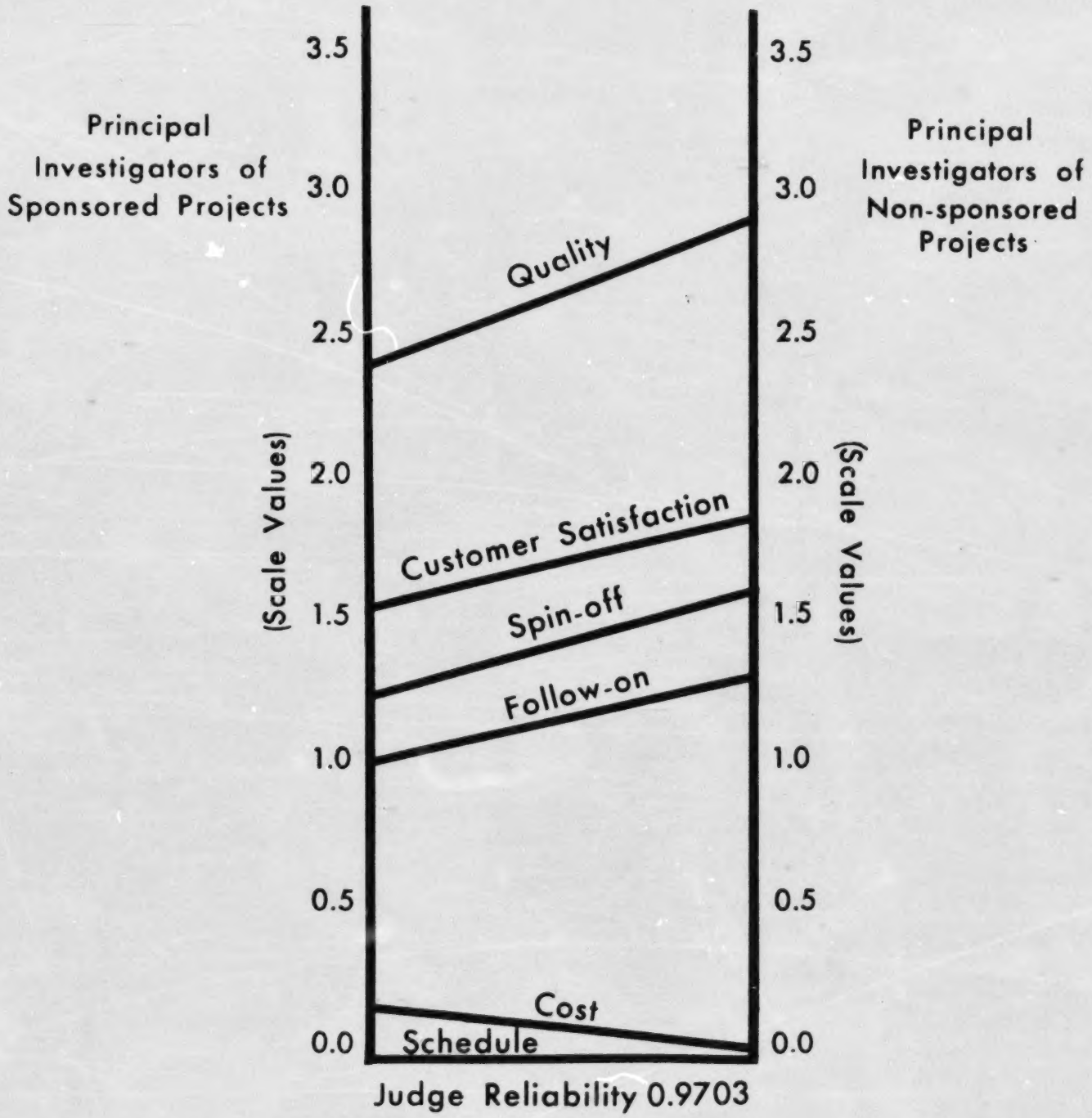

Figure 4

COMPARISON OF SCALE VALUES GIVEN TO CRITERIA OF PROJECT SUCCESS BY PRINCIPAL INVESTIGATORS OF SPONSORED AND NON-SPONSORED PROJECTS

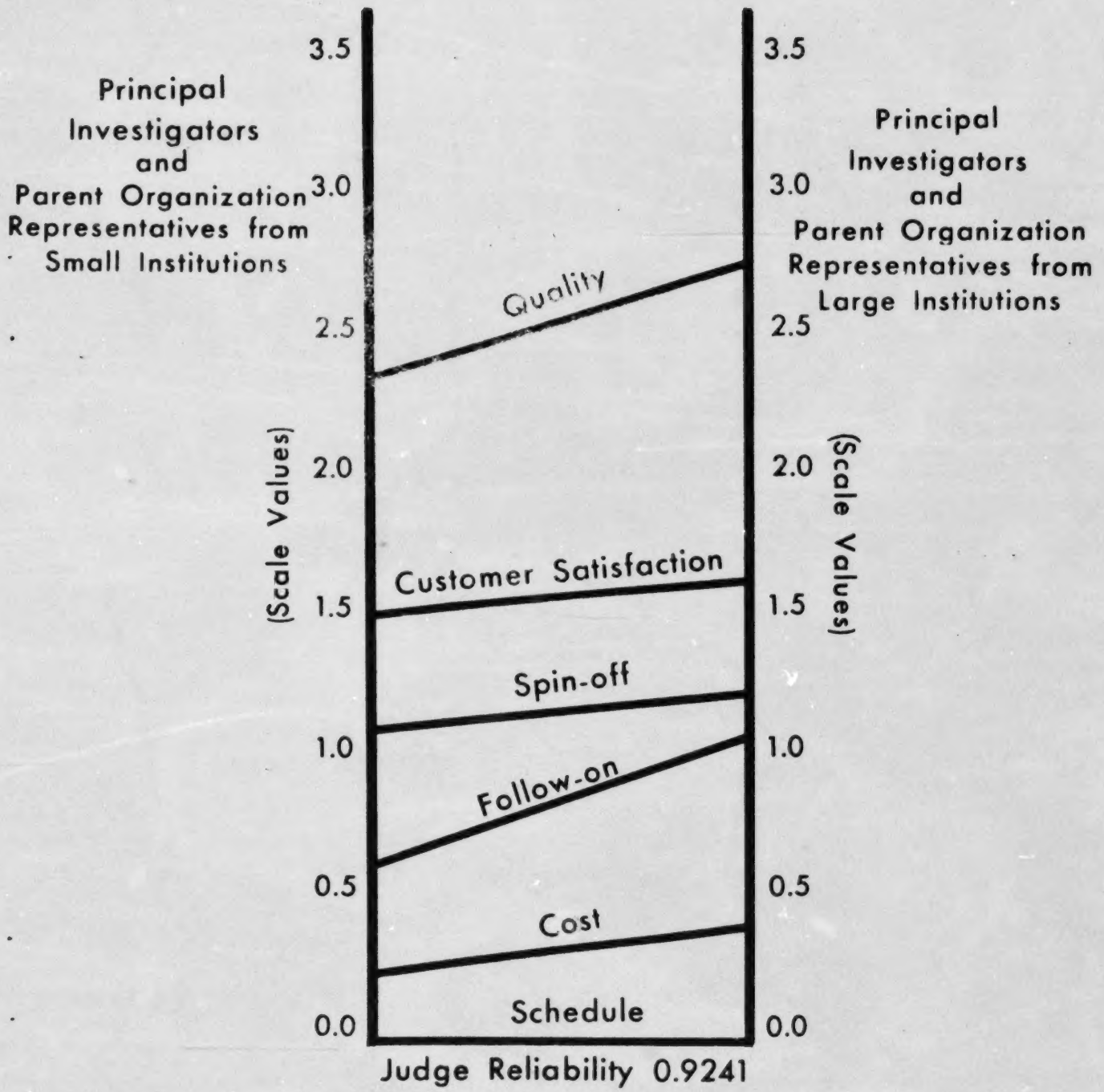

Figure 5

COMPARISON OF SCALE VALUES GIVEN TO CRITERIA OF PROJECT SUCCESS BY PRINCIPAL INVESTIGATORS AND PARENT ORGANIZATION REPRESENTATIVES FROM LARGE AND SMALL INSTITUTIONS

APPENDIX

Criteria Ranking

Listed below in pairs are the criteria of project success that were defined on the previous page. Select the criterion in each pair that you feel is the more important of the two in judging the success of a project. Place an "x" before the more important criterion of project success in each pair. After you have finished, turn the page and continue.

1. ___ customer/client satisfaction
   ___ cost

2. ___ quality/performance
   ___ schedule

3. ___ cost
   ___ spin-off

4. ___ schedule
   ___ follow-on work

5. ___ spin-off
   ___ quality/performance

6. ___ customer/client satisfaction
   ___ schedule

7. ___ follow-on work
   ___ quality/performance

8. ___ schedule
   ___ cost

9. ___ quality/performance
   ___ customer/client satisfaction

10. ___ spin-off
    ___ follow-on work

11. ___ cost
    ___ quality/performance

12. ___ customer/client satisfaction
    ___ follow-on work

13. ___ schedule
    ___ spin-off

14. ___ follow-on work
    ___ cost

15. ___ spin-off
    ___ customer/client satisfaction

Project Success Rating Scale

PROJECT NUMBER _____ PROJECT PRINCIPAL INVESTIGATOR _____

PROJECT TITLE _____

_____

The several criteria of project success defined before appear below in a rating scale format. Rate the project identified above on each of these criteria. Cross out the number on each scale that best approximates your rating of the project on that criterion. At the bottom of the page indicate your familiarity with the project.

Schedule ..... 1 — 2 — 3 — 4 — 5 — 6 — 7
far behind schedule — on schedule — far ahead of schedule

Cost ..... 7 — 6 — 5 — 4 — 3 — 2 — 1
far under — on predicted cost — far over

Quality/Performance ..... 1 — 2 — 3 — 4 — 5 — 6 — 7
standards far from met — standards met — standards greatly exceeded

Customer/Client Satisfaction ..... 7 — 6 — 5 — 4 — 3 — 2 — 1
extremely satisfied — quite satisfied — somewhat satisfied — unsatisfied

Spin-off ..... 1 — 2 — 3 — 4 — 5 — 6 — 7
no spin-off — some spin-off — moderate spin-off — substantial spin-off

Follow-on Work ..... 7 — 6 — 5 — 4 — 3 — 2 — 1
substantial follow-on — moderate follow-on — some follow-on — no follow-on

Overall Success ..... 1 — 2 — 3 — 4 — 5 — 6 — 7
unsuccessful — somewhat successful — quite successful — extremely successful

Your familiarity with project. ..... 7 — 6 — 5 — 4 — 3 — 2 — 1
extremely familiar — quite familiar — somewhat familiar — unfamiliar